Management of Mixed Species Pastures Under Rotational Grazing: Forage Availability, Nutritional Quality and Species Composition

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Introduction

Increasing numbers of livestock producers are considering grazing as a low-cost, profitable alternative to conventional dairying. This awareness has increased the demand for information on integrating pasture as a significant component of on-farm feed production. Mixed species pastures constitute a large and under-utilized resource on many livestock farms in the northeastern and north central U.S. These pastures are dominated by cool season species and are often termed as "natural" (i.e., not planted or tilled in a long time) or "permanent" pastures. Under good grazing management, these pastures have the potential to persist indefinitely while producing forage profitably.

In New Zealand and Europe, information on forage available for daily intake under grazing is provided to livestock producers for feed budgeting or enterprise planning. This information enables producers to match animal feed requirements with forage availability, which minimizes wasteful overfeeding of supplements while reducing feed costs and nutrient overloading on farms. Such information is scant for managing pastures profitably in the region.

The objective of this study was to provide livestock producers practicing intensive rotational grazing with quantitative estimates of forage available for daily intake by cattle grazing a mixed-species pasture.

Materials and Methods

Grazing management. A 50-acre pasture, located in Prairie du Sac, WI, was managed under a typical system of rotational grazing with lactating cows during May to October in 1994 and 1995. Rotation length was about 17 days each for grazing cycles 1 and 2, and about 30 days each for the other cycles. A new paddock was grazed each day. Forage allocation and animal movement were managed based on pasture height. Pasture height just before grazing averaged 7.1 inches while the stubble left behind after grazing measured 3.7 inches. The corresponding biomass amounts were 3373 and 2115 lb/acre. The pasture height was measured with a "rising" plate meter 12 in. x 12 in. which exerted a pressure of 0.51 lb per square foot on the canopy. To promote legume growth, fertilizer N was limited to 60 lb N/acre/yr, which was applied in two equal splits during the third and fifth grazing cycles.

Forage sampling. Forage availability, forage nutritional quality and species composition were measured across the grazing season on two 1-acre paddocks. Forage availability was calculated as: $G_i=(W_s-W_o)/T_r$, where, G_i is the forage availability during cycle, i (lb/acre/d), W_o (lb/acre) is the post-grazing biomass and W_s (lb/acre) is the pre-grazing biomass measured after a regrowth duration of T_r (d). Forage availability data presented in Fig. 1 and Table 1 represent daily amount of forage dry matter available for intake during a grazing cycle.

Nutritional quality of forage consumed was estimated as: $Q_{int} = (Q_s \times W_s - Q_e \times W_e)/(W_s-W_e)$, where Q_s and Q_e stand for crude protein (CP), neutral detergent fiber (NDF) or acid detergent fiber (ADF) as % dry matter in forage harvested before or after grazing, respectively. W_e (lb/acre) represents post-grazing biomass, and is equivalent to W_o for cycle, i+1. Q_{int} represents quality of forage consumed (CP, NDF or ADF, % dm).

Results and Discussion

Applied questions. What is the daily amount and quality of forage available for intake from a rotationally grazed mixed species pasture?

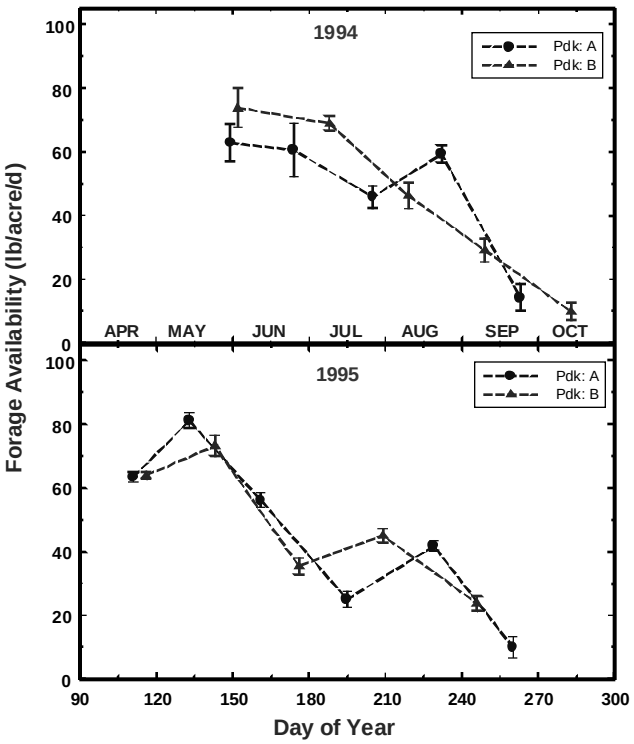

Figure 1. Forage available daily for animal intake under rotational grazing in 1994 and 1995. (Vertical bars represent standard error of mean.)

Quantitative estimates of forage available for daily animal intake measured across the grazing season are shown in Fig. 1 and Table 1. In most years, soil moisture may not be limiting pasture growth until late June, because soils are recharged with water from snow and early spring rains. Consequently, forage availability may be expected to be fairly uniform during this period. For the period of June-September, forage availability varies depending upon the duration and severity of moisture stress. Due to better distribution of rainfall during much of the grazing season in 1994, estimates of forage availability for 1994 may be representative of a "normal" year or a year with adequate rainfall while the data obtained in 1995 may reflect forage availability under extended periods of dry weather during summer. During September and October, temperature and light may be more limiting than soil moisture, and forage availability seems to drop steadily to about 10 lb/acre/d by the end of October.

Under adequate moisture conditions, these pastures have the potential to provide 3.8 t/acre of forage dry matter for intake under rotational grazing in a year (Table 1). Nutritional quality of forage consumed during the grazing season is shown in Table 2. Averaged over the years, forage consumed contained 22% CP, 45% NDF and 24% ADF.

What is the effect of intensive rotational grazing on species composition of the pasture?

Averaged over the two years, pasture dry matter was composed of 22% Kentucky bluegrass, 33% all other grasses combined (mostly smooth bromegrass and quackgrass), 13% legumes (mostly white clover), 27% dead matter and 5% all other species combined (Fig. 2). While more years of data are required to accurately assess the impact of rotational grazing on species composition, our data indicated little change in pasture composition during the grazing season, except under extended periods of drought. Under intense and long periods of dry weather which were observed in late August and September of 1995, dead matter fraction in the pasture increased to more than 50% while grass and legume fractions declined (Fig. 2). Bluegrass and white clover suffered the most under drought, but they recovered quickly to their original percentages upon return of favorable moisture conditions. Consequently, the pasture composition may remain fairly stable from year to year under the system of grazing management imposed even though significant but transient changes were observed within a grazing season.

However, under extended drought conditions, grazing low into the stubble may risk intake of poor quality forage because of the excessive amount of dead material in the forage.

Table 1. Daily and seasonal forage availability under rotational grazing in 1994 and 1995.

Grazing period	Grazing cycles[1] #	Forage availability 1994 Daily lb/ac/d	1994 Period lb/acre	1994 Total[2] lb/acre	1995 Daily lb/ac/d	1995 Period lb/acre	1995 Total lb/acre
05/01-06/01	2.0	68.3	1981	1981	70.5	2044	2044
06/01-08/15	2.5	59.0	4282	6263	40.7	2949	4993
08/15-09/15	1.0	34.3	1028	7291	25.2	755	5748
09/15-10/15	1.0	12.1	364	7655	nd[3]	nd	5748

[1]Number of grazing cycles during the specified grazing period.
[2]Total represents cumulative yield from start of the grazing season.
[3]No data; extended period of drought ended the grazing season.

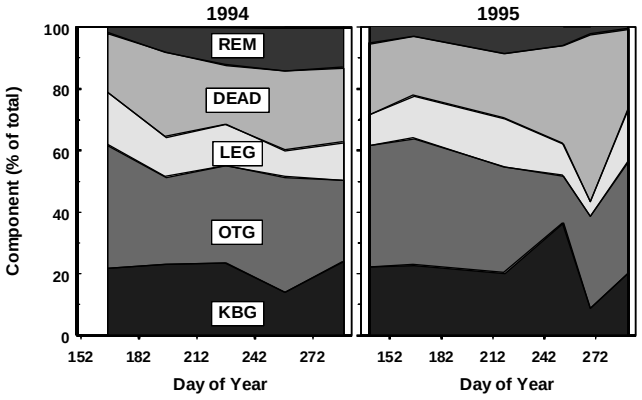

Figure 2. Changes in pasture species composition under rotational grazing in 1994 and 1995. [KBG = Kentucky Bluegrass; OTG = Other grasses (mostly smooth bromegrass and/or quackgrass); LEG=Legumes (mostly white clover); DEAD = dead matter; and REM = all other species (mostly dandelion or thistles)]

Table 2. Concentration of crude protein (CP), neutral detergent fiber (NDF) and acid detergent fiber (ADF) in the forage consumed under rotational grazing in 1994 and 1995.

Sampling period[1]	CP	NDF	ADF
	- - - - % dry matter - - -		
		1994	
5/22 - 6/1	17.5	54.9	26.4
6/23 - 7/7	20.4	44.5	26.7
7/24 - 8/7	23.0	48.5	28.9
8/20 - 9/6	23.5	46.1	24.9
9/20	22.7	37.1	19.6
mean	21.3	47.2	25.9
SE	.94	2.06	1.40
		1995	
4/21 - 4/26	23.2	42.8	16.4
5/13 - 5/23	23.2	32.8	17.3
6/1 - 6/25	22.7	43.8	20.4
7/14 - 7/28	22.8	48.9	30.2
5/17 - 9/3	24.1	49.1	26.2
9/17	20.2	39.5	19.9
mean	23.0	43.1	21.9
SE	0.76	1.91	1.88

[1]Data from 2 paddocks averaged for grazing cycle.